



Electrical systems in the electroplating industry

Engineering Sheet No 6 (rev)

Introduction

Electroplating involves the use of low voltage high current DC derived from rectifier units operating at primary voltages of 415 volts AC. Auxiliary equipment typically includes pumps, filters, blowers, centrifuges, heaters (fixed and transportable) as well as hand-held portable tools and instruments. Automated plants incorporate conveyors, and lifting and manipulating equipment operated by control systems which range from simple contractor systems to sophisticated microprocessor controls.

The problem

Electroplating uses conductive and corrosive fluids, and the atmosphere in plating shops is often humid and laden with corrosive mist. The fact that people often have to

work close to electrical systems and exposed conductors means that, unless properly controlled, the combination of electricity, water, damp and corrosive conditions can be lethal.

Similar hazards, ie injury from electric shock, electric burn, electrical explosion or arcing, or from fire or explosion initiated by electrical energy, apply to all plants.

The Electricity at Work Regulations 1989 (EAW) set out the precautions to be taken for preventing the risk of injury from electricity in work activities, and the principles of electrical safety which should be applied to these systems and work activities.

Typical faults which have been found in the electroplating industry are listed below.

Common faults in the use and maintenance of electrical systems in electroplating shops

<i>Maintenance of system</i>	<i>Inadequate installation</i>
● Exposed live conductors at 415/250V	● 'DIY' work by incompetent personnel
● Damage/perished insulation	● Not suitable for use in wet or corrosive conditions
● Covers missing from junction boxes, isolators etc	● Makeshift joints in conductors
● Broken plugs/sockets and switchgear	● Inappropriate equipment, eg leads trailing in water
● Heaters not earthed	● Inadequate working space/access to equipment
● Makeshift joints in conductors	● Cable not protected by conduit, or conduit broken
● Corrosion of system parts, access grilles etc	● Inadequate excess current protection
● Transformers/rectifiers not checked, eg to ensure 'breakthrough' integrity	● Bridging risk of opposite polarity busbars
● Immersion heaters not properly set and maintained	● Means of isolation badly sited (not readily accessible)
● Means of isolation in poor condition	

Much can be done to reduce the risk from electrical systems in the electroplating industry. The following advice gives guidance on what to do to make plant and equipment safe, to keep it in a safe condition and to comply with the law.

Strategy for effective control of the electrical system

Knowledge of the system

The first step is to identify the system and the equipment which is or may be connected to it. This includes not only the electroplating equipment, but also the supply of electricity into the factory, the main distribution switchboards and distribution system throughout the premises to the various items of plant.

Survey

A survey should be carried out. This will entail the physical inspection and examination of the system and its equipment, and appropriate testing to determine its condition and suitability for use.

The information obtained will enable the preparation of the following:

- An inventory and details of the electrical equipment; this should be obtained from the name plate on the equipment, or from the supplier/manufacturer
- Details of standards, if any, to which it was made
- Year of manufacture if known and year of installation
- Operating voltage/current etc
- IP classification (ie the measure of protection it gives against the ingress of moisture etc)
- Records of any circuit diagrams or electrical manuals for the equipment and modifications made to it
- Diagram or diagrams of the electrical system showing how it is arranged and how the equipment is interconnected, eg supply to rectifier units/control panels and from rectifiers to busbars etc
- The diagram information should include data on the fault levels and fault protection (eg fuses, circuit breakers etc) installed
- Layout drawings showing the location of the plant and electrical equipment - this will enable identification of the areas where the working space is inadequate
- Circuit identification and what the equipment controls/supplies

- Means of isolation and its location
- Earthing arrangements of the system
- Type and size of cables

To have any value the survey should be carried out by a suitably electrically qualified competent person who can determine what satisfies the EAW Regulations.



Electrical equipment housing held closed with string

Remedial action - determining priorities

An adequate survey will identify problem areas of the system and equipment/conditions needing attention. It will also enable a programme of remedial work to be prepared and prioritised. The greater the risk of injury, the greater the priority it needs.

Programme of remedial work

This should set realistic time-scales - but the use of those items identified as likely to cause serious injury **should be stopped immediately**. This would include unsuitable mains operated equipment with exposed conductors or inadequate earthing and fault protection. Conditions which represent less risk can be dealt with on a programmed basis, but interim measures must still comply with the Regulations.

Working methods

Examination of the working methods is important; it could identify areas where alternative working arrangements may eliminate the need to work on or near dangerous live conductors.

The requirements of Regulations relating to work on or near live conductors must be met. To decide how this is to be done the person in control should assess the risk and determine the precautions to be taken. This is vital where fault finding on electrical systems is done with the equipment live.

Maintenance of electrical systems

Having put the system into good order and brought it to the level which is safe and therefore meets the requirements of the EAW Regulations, it is essential to maintain the system and working practices at this level, to prevent danger so far as is reasonably practicable. Preventive maintenance should be carried out on a routine basis and monitoring procedures should be instituted to ensure maintenance is effective, ie relevant and performed properly.

It will be necessary to determine: what is to be maintained (do not forget to include equipment which, though not in use, is intended to be used or installed for use); the form the maintenance will take; how frequently it should be done; and, who will do it.

The method and frequency of maintenance should be based on knowledge of the condition of the system (gathered from the survey and resulting remedial action) and practical experience of its use. The inspection techniques and testing will be similar, or identical, to those used during the initial survey.

Note: The work should only be carried out by competent persons who are sufficiently trained and experienced to make judgements about the condition and safety of the equipment and its suitability for continued use. Where necessary these competent persons should also be able to:

- (a) carry out any appropriate diagnostic and integrity testing and interpret the results of such tests; and
- (b) carry out maintenance based on any guidance given in manufacturers' manuals or contained in guidance notes and standards.

Once the maintenance requirements have been determined, a work routine should be established. This will involve the preparation of programmes of work; the methods of recording what has been done; and the results of any tests made. These records will provide a picture of the condition of the system and equipment, indicate when equipment should be replaced, and

identify unsuitable and abused equipment. They will also provide information to enable the effectiveness and quality of the work to be monitored.

Control of the system

Employed and self-employed people have a duty to comply with the provisions of the EAW Regulations 'in so far as they relate to matters which are within their control'. While directors or managers may have considerable knowledge of electroplating processes they may not have the necessary expertise to determine whether the system meets the requirements of the Regulations. They have responsibility for deciding when and whether expert help should be sought.

Individual employees also have duties. In addition to being required to co-operate with their employer to enable them to fulfil their duties under the Regulations they also have to comply with the Regulations 'in so far as they relate to matters which are within their control'. If therefore a job is allocated to employees which involves operations or work on or near the system, employers should clearly identify the matters which are within their employees' control and provide the necessary training and protective equipment.

If consultants and/or contractors are engaged to do the work, a director or responsible manager should satisfy him/herself that they are competent, eg by seeking advice from organisations such as the Institution of Electrical Engineers (for consultants) and the Electrical Contractors Association (for contractors).

Summary

Many electroplating shops visited by HSE Inspectors have poor, often dangerous electrical systems. These conditions are caused by the use of unsuitable equipment (in many instances second-hand and in poor condition); neglect; lack of adequate knowledge; ignorance of what is dangerous; work done on the system/equipment by people who are not competent to do it.

The EAW Regulations are there to protect lives. This information sheet outlines a strategy which could be adopted to achieve compliance - and shows how to build on the improvements made.

Remember also the commercial advantage in having a well constructed, properly maintained system: down (outage) times should be reduced, the system equipment will work as designed, will be more efficient and have a longer useful life.

Useful information

Memorandum of guidance on the Electricity at Work Regulations 1989 HSR25 HSE Books 1989
ISBN 0 11 883963 2

Maintaining portable and transportable electrical equipment HSG107 HSE Books 1994
ISBN 0 7176 0715 1

Electricity at work: safe working practices
HSG85 HSE Books 1993 ISBN 0 7176 0442 X

Safety guidelines for industrial electric immersion heaters British National Committee for Electroheat (BNCE) 1985, 30 Millbank, London SW1P 4RD

BSTSA/LPC Joint code of practice electrical process heating - fire safety in the metal finishing industry
Surface Engineering Association, 10 Vyse St, Birmingham B18 6LT

Electrical test equipment for use by electricians
GS38 (rev) HSE Books 1995 ISBN 0 7176 0845 X

Electrical safety and you INDG231 (single copies free; ISBN 0 7176 1207 4 for priced packs of ten copies)

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